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THE INFLUENCE OF DIGITAL LEADERSHIP ON SUSTAINABLEPERFORMANCE: THE MEDIATING ROLES OF DIGITAL ORGANIZATIONAL CULTURE, AND THE MODERATING ROLE OF ORGANIZATIONAL AGILITY

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Abstract

The accelerating pace of digital transformation compels organizations to cultivate leadership and cultural capabilities that can generate both economic and environmental value. Grounded in dynamic capabilities theory, this study examines how digital leadership capabilities influence digital organizational culture and how this culture impacts economic and environmental performance, with organizational agility modeled as a moderator. A quantitative, cross-sectional design was employed, utilizing data collected from managerial respondents that were 342 across multiple industries. Partial Least Squares Structural Equation Modeling (PLS-SEM) was applied

to test hypothesized relationships. Findings indicate that digital leadership exerts a significant positive effect on digital organizational culture, which strongly predicts economic performance but does not significantly influence environmental performance. Organizational agility both enhances digital culture directly and negatively moderates the leadership–culture relationship, suggesting diminishing leadership effects at high agility levels. These results highlight the centrality of culture as a conduit for economic returns and highlight that environmental gains require additional green digitalization practices or sustainability-oriented capabilities. The study offers theoretical and practical implications for aligning leadership, culture, and agility in pursuit of digital transformation outcomes.

Keywords: *Digital Leadership, Sustainable Performance, Digital Organizational Culture and Organizational Agility*

Introduction

In the contemporary business landscape, the imperative to remain competitive and sustainable is increasingly defined by an organization's capacity to adapt to digital transformation. Globalization, technological disruptions, and the intensification of environmental concerns have fundamentally altered traditional business paradigms. Organizations no longer thrive solely through operational efficiency; they must now leverage digital capabilities to remain agile, responsive, and value-driven. This digital shift is not just about technology adoption—it necessitates a fundamental reorientation of leadership practices, cultural configurations, and performance outcomes (Alakaş, 2024). As industries navigate this volatile environment, there is growing academic discourse around the mechanisms through which digital leadership contributes to sustainable competitive advantages (Zhou et al., 2023). A salient theme emerging from this discourse is the recognition that digital transformation is deeply embedded in cultural and organizational dynamics. Without the right leadership mindset or cultural adaptability, even the most advanced digital tools can fail to deliver anticipated performance outcomes. This realization has prompted a scholarly interest in exploring how digital leadership fosters organizational readiness, resilience, and sustainability through more nuanced, internal mechanisms

such as culture and agility (Rahman et al., 2022). These internal capabilities play a critical role in influencing broader economic and environmental outcomes, especially in increasingly complex global value chains.

Recent studies highlight the centrality of leadership and culture in driving successful digital transformations. It is well-established that digital leadership plays a catalytic role in organizational adaptation by facilitating innovation, strategic thinking, and agility (Zupic et al., 2023). Simultaneously, digital organizational culture has been identified as a critical enabler of change, mediating the relationship between leadership intent and employee engagement (Chen et al., 2022). Several empirical investigations suggest that organizations possessing agile structures and cultures oriented toward learning and innovation are better positioned to generate superior performance outcomes, both economically and environmentally (Li et al., 2023). However, despite the abundance of research focusing on digital capabilities or agility as individual constructs, the integrated pathway through which digital leadership capabilities cascade through cultural and agile orientations to influence performance metrics remains less thoroughly examined (Asif et al., 2024). There is an emerging recognition that performance in the digital era is less about isolated competencies and more about dynamic, interdependent capabilities shaped by leadership, agility, and culture.

Globally, organizations face mounting pressure to enhance both economic competitiveness and environmental responsibility. The United Nations Sustainable Development Goals (SDGs) and international environmental agreements have pushed businesses to reconsider their operational models to align with sustainability goals. Meanwhile, rapid technological change, exacerbated by the COVID-19 pandemic, has accelerated the urgency for digital transformation across sectors (World Economic Forum, 2023). Nationally, governments are pushing digital infrastructure investments and green innovation as part of economic recovery strategies (Fakhfakh et al., 2025). In emerging markets like Pakistan, where digital readiness and environmental challenges intersect, organizations face compounded pressures to modernize while preserving resource efficiency. Yet, digital adoption without a guiding leadership vision or aligned organizational culture risks

superficial change. According to a recent PwC (2023) survey, over 60% of firms undergoing digital transformation failed to meet sustainability targets due to cultural misalignment and leadership disconnect. As environmental regulations tighten and consumer expectations evolve, firms must cultivate internal capabilities that bridge digital strategies with sustainability imperatives. This calls for a reevaluation of how digital leadership and internal dynamics such as agility and culture contribute not just to financial performance but also to environmentally responsible outcomes (Jasim et al., 2024). Therefore, understanding these mechanisms has become a vital concern for scholars, practitioners, and policymakers alike.

While the literature on digital leadership, organizational agility, and digital transformation is growing, significant gaps remain in understanding how these elements interact to influence dual performance outcomes, economic and environmental. Many studies have addressed digital leadership in isolation, focusing on its impact on innovation or strategic direction (Lee et al., 2022). Others have explored agility and culture independently as organizational capabilities linked to performance (Zhou et al., 2023). However, research has yet to comprehensively explore the integrated mechanism by which digital leadership capabilities shape organizational agility and culture, and how these affect multidimensional performance metrics (Karafakıoğlu & Fındıklı, 2024). More specifically, the mediating role of digital organizational culture and the moderating or reinforcing influence of agility remain under-theorized. Despite acknowledgment that culture can either enable or obstruct technological change, there is limited empirical research that positions it as a pivotal conduit linking leadership with sustainability performance. Existing research disproportionately focuses on economic indicators, often neglecting environmental performance, which is now an equally critical measure of organizational success (Mollah et al., 2024). This gap is particularly acute in the context of emerging economies, where environmental sustainability often takes a backseat in digital strategies due to limited institutional capacity or short-term profit imperatives (Mollah et al., 2024). There is a compelling need to investigate how digital leadership, when combined with cultural alignment and agile practices, can lead to balanced economic and environmental

performance outcomes. Addressing this gap offers a more holistic view of organizational transformation in the digital era.

Understanding the interplay between digital leadership, organizational culture, agility, and performance outcomes is crucial for both theory and practice (Razzak et al., 2025). On a practical level, organizations are investing heavily in digital initiatives, yet many fail to realize their expected returns, particularly in sustainability-related metrics. According to McKinsey (2022), only 30% of digital transformation efforts yield successful outcomes, largely due to the lack of internal alignment and leadership commitment (Tahir et al., 2024). From a policy perspective, sustainable development frameworks require businesses to not only pursue economic growth but also minimize ecological footprints. If digital transformation is to contribute meaningfully to this dual mandate, it must be rooted in leadership practices that cultivate a responsive and responsible organizational culture. In academic contexts, the integration of leadership, agility, and culture as interdependent variables in performance research is still emerging. Without such integrated models, the literature risks offering fragmented insights that are insufficient for guiding holistic transformation. Most extant studies are situated within developed economies, limiting their applicability to contexts where digital maturity is still evolving (Xiufan & Yunqiao, 2024). By studying these constructs together, particularly in under-researched contexts, scholars can better understand the structural conditions necessary for both economic resilience and environmental stewardship in the digital age.

This study provides a novel contribution by presenting an integrated framework that links digital leadership capabilities to both economic and environmental performance through the mediating role of digital organizational culture and the enabling influence of organizational agility. By examining this model in the context of an emerging economy, the research enhances understanding of how internal organizational mechanisms can align digital strategies with sustainability goals. The study bridges gaps between leadership theory, organizational capabilities, and sustainability literature, offering actionable insights for academics and practitioners navigating digital transformation.

The study is underpinned by the Dynamic Capabilities Theory, which emphasizes an organization's ability to adapt, integrate, and reconfigure internal competencies in response to rapidly changing environments. This theoretical lens connects the key constructs of digital leadership, agility, and culture by positing them as strategic capabilities that enable sustainable performance. By applying this framework, the research contributes not only to leadership and digital transformation literature but also to sustainability and performance studies. It offers a theoretically grounded understanding of how firms can build internal capacity to achieve balanced outcomes in an increasingly digital and environmentally constrained world.

Theoretical Foundation

The Dynamic Capabilities Theory (DCT) provides a comprehensive lens for understanding how firms can sustain competitive advantage in environments characterized by rapid technological, market, and institutional change. The theory developed out of the shortcomings of the traditional resource-based view (RBV) is stated by Teece and colleagues in late 1990s when aiming at determining the dynamic nature of strategic management. Unlike RBV that placed the stress on the firm holding the valuable, rare, inimitable and substitutable resource, DCT placed the stress on the capability of the firm in continuously integrating, reconfiguring, renewing and adapting the competences both internal and external to the firm in accordance with changing environments (Teece, 2007). The theoretical framework has since grown over the years and it has encompassed a larger strategic logic, which focuses on agility, learning, innovation, and organization renewal as basic part of performance and resilience in fluent environment.

In its contemporary form, DCT emphasizes three fundamental capacities: the ability to sense opportunities and threats in the environment, to seize these opportunities through appropriate resource configurations, and to transform or reconfigure existing capabilities to maintain relevance and effectiveness (Teece et al., 2016). The capacities are not just technical or functional but they run deep into social, cognitive and cultural fibers of an organization. Leadership is a very significant element in implementing dynamic capabilities, such as defining strategic visions, arranging cross-functional links, and institutionalizing a culture of ongoing learning and responsiveness (Di Stefano

et al., 2022). Notably, the strategy proposed here recognizes the fact that dynamic capabilities are path-formative as well as a product of organizational routines, processes and values, all of which differ radically in firms and across contexts. There has been recent theoretical development to apply DCT to digital transformation and sustainability, and the capabilities are becoming inventively important to survive in the twin demands of technology disruption and environmental stewardship (Liu et al., 2023). Registration of changes in the technological trajectories or expectations of consumers in digitally intensive settings requires firms to quickly respond to changes as they restructure their operations, structures, and cultural norms to preserve their market viability and ability to act according to the requirements of the environment (Alakaş, 2024). The modern digital economy of rapid cycles of innovation and interconnected networks of the planet are making the dynamic capabilities both a theoretical and practical need (Raimo et al., 2022).

DCT's relevance is particularly pronounced in organizational contexts where digital infrastructures, leadership orientations, and cultural readiness interact to determine strategic outcomes. The theory explains the process of mobilizing the intangible assets in the form of knowledge, values and capabilities in supporting complex change processes. Additionally, its stress on the consistent learning and adjusting is compatible with the current quest of sustaining performance, as companies are required to revise their business clients, relations with stakeholders, and ways of operation regularly (Fakhfakh et al., 2025). The theory is therefore able to offer a comprehensive framework within which people are able to interpret the mechanisms that allow firms to succeed in spite of the digital transformation and environmental complexity. DCT is a strong base that would be used in establishing studies on how organizations with intangible organizational capabilities would bring together the elements in the firm, that is, integrating and renewing it, aligning the internal capabilities to the external pressures to achieve whole and sustainable performance. It goes beyond a limited causality or even linear modeling in providing an explanation of evolutional evolution and organizational resilience in a systems respective (Xiufan & Yunqiao, 2024). Based on that, it provides essential theoretical foundations to the empirical models that desire

to examine intricate interdependencies between leadership, culture, agility, and performance outcomes within the digitally dynamic environment.

Hypotheses Development

The rapid pace of digital transformation has prompted scholars to re-evaluate the role of leadership in shaping the internal structures and cultural configurations of organizations. In contrast to traditional paradigms of leadership, which mostly revolve around hierarchical control or transactional coordination, digital leadership is all about being a vision-oriented leader, who should be highly proficient in technology, adaptable, and capable of promoting innovation in every level of the organization (Cortellazzo et al., 2022). Such leadership orientation moves beyond the circles of conventional managerial practices as it works towards enhancing a forward-thinking, risk-taking, and knowledge sharing environment in companies. Culture in itself, acts as an ingrained and long-standing pattern of joint values, principles, and presupposition affecting the manner in which personnel behaves and the course of action (Karafakıoğlu & Fındıklı, 2024). This domain of culture turns out to be even more important in digital-intensive settings, where it defines how people are more or less ready to make the transition to a new technological order (Al-Mamary & Hassan, 2022). Empirical studies have indicated that leaders with a digital acumen and their cultures of openness to transformations play an indispensable role in developing digital organizational cultures, which is agile, experiment-focused, and collaborative-learning-based (Shao et al., 2023).

H1: Digital leadership capabilities are positively associated with a digital organizational culture.

Digital Organizational Culture and Economic/Environmental Performance

In the evolving discourse on organizational performance, scholars increasingly acknowledge the role of organizational culture as a critical determinant of long-term competitiveness and sustainability. As much as traditional methods (consequently used to understand the back of leadership, technology, structures) have tended to support technological or structural determinants, the tendency at present is switching to cultural orientations as the most significant factor that contributes to the performance of the organization in terms of innovation, adaptation, and ability to produce the outcomes required

to Sunday its strategic performance (Shao et al., 2023). Digital organizational culture can be defined as a commonality of values, beliefs, and behavior, connected to embrace digital fluency, constant learning, experimentation, and welcoming change related to technology (Al-Mamary & Hassan, 2022). Cultural arrangements of this sort not only allow the prompt response of firms to the upheavals of the digital world but also contribute to the internal cohesion towards the strategic goals (Tahir et al., 2024).

From a strategic management perspective, firms with digitally aligned cultures are better positioned to reconfigure resources and leverage digital tools in ways that improve operational efficiency, decision-making, and customer engagement—all of which are critical drivers of economic performance (Jung et al., 2022). According to empirical evidence, highly digitally cultured organizations demonstrate over-proportionally high statistics on financial improvement, market agility, and profitability based on innovations, which prompts the idea that matched cultures can make digital transformation projects more economically valuable (Li et al., 2023). At the same time, the organizational culture-environmental performance also attracted the attention of scholars, especially in the context of sustainability imperatives. Digital organizational culture has the tendency to increase openness, the use of data in tracking performance, and cross-function interaction- aspects that are critical in detecting environmental risks, rationalizing resource utilization, and making environmentally friendly habits (Raimo et al., 2022). Companies with these kinds of cultures approach the spirit of ecological stewardship more seriously, and tend to adopt digital technologies that favor the reduction of carbon footprint, management of wastes, and energy efficiency. In such a way, culture serves as a medium of social infrastructure, which allows not only following the environmental standards, but also being sustainable at the same time. (Razzak et al., 2025).

The theoretical justification of this relationship is offered by Dynamic Capabilities Theory, which states that organizational culture is the reconfigurable internal capability that forms opportunity sensing, resource capturing, and transformation in the operations of firms, which respond to complex and dynamic environments (Teece et al., 2016). In its sense, though, a digital culture is the expression of adaptive capacity in the firm because it

allows it to coordinate the digital competencies with its economic objectives and environmental responsibilities. Based on this theoretical and empirical foundation, the following hypotheses are proposed:

H2: Digital organizational culture is positively associated with a firm's economic performance.

H3: Digital organizational culture is positively associated with a firm's environmental performance.

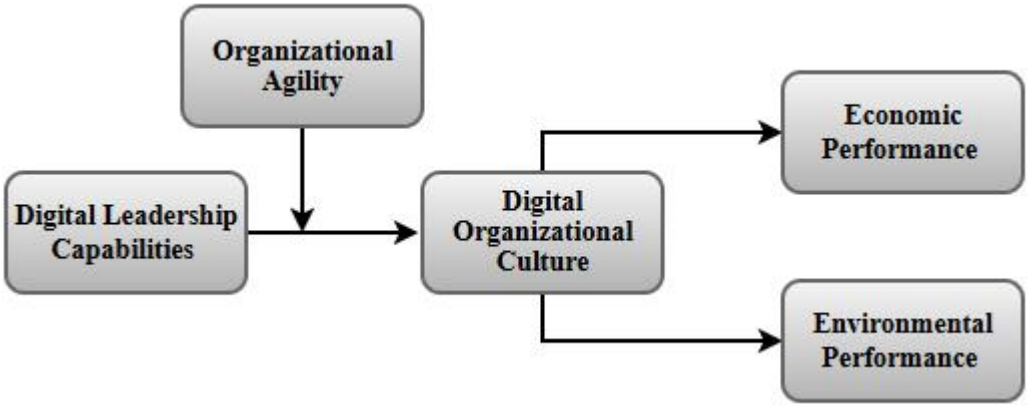
The Moderating Role of Organizational Agility

Uncertainty and accelerated technological advancement, organizations are increasingly evaluated not only by their capacity to adopt digital tools, but by how swiftly and effectively they can recalibrate in response to evolving internal and external stimuli. This readiness is synthesized as the idea of organizational agility as a meta-capability that promotes prompt sensing of the change in the environment, expedite decision-making, change in the allocation of resources, or a dynamic implementation of strategies (Shams et al., 2022). As opposed to operational flexibility, agility is strategic in nature and it enables an organization to translate ideas into action quickly and accurately. Agility is the glue, without which both leadership and culture would perform in a static nature. Agility is system dynamic that closes the gap between the intentions of leadership and the realization of a culture through offering the channels through which change efforts are materialized into the systemic procedures and organizational practices (Li et al., 2022). This ability is especially important in the conditions of a digital transformation. Leaders can have great digital vision and a desire to promote cultural change, but unless they are prepared to be agile, they easily come across resistance, inertia or even a lack of fit between the intended change and the company culture. Therefore, agility is not only a tool that improves performance within the context of an operate environment, rather it forms a condition of context because it determines how well leadership behaviors affect cultural progress.

Dynamic Capabilities Theory offers a robust foundation for this proposition. It theorizes agility as capacity hierarchy rather than a property and by enabling firms to continually redesign their routines and social structures to correspond to arising possibilities and threats (Teece et al., 2016). This reconfiguration involves in digital intensive environments the restructuration

of organizational values, beliefs, and behavioral norms in respect to the leadership stimuli. Even where digital leadership abilities are strong, culture change is apt to be deeper in the event of organizational agility. On the contrary, in low agility environments even visionary digital leaders will face an uphill battle on the way to establish a new cultural norm because the structure is rigid, and reaction cycles are slow. This theoretical argument is also sustained by empirical research. It has been revealed that agile organizations are better able to generate innovation-friendly cultures due to leadership purpose in relation to innovation support during projects of digital transformation (Popli et al., 2023). Being agile also improves internal lines of communication, encourages cross-functional teamwork, and makes it possible to experiment iteratively, activities in which cultural adaptation is most likely to move productively forward. Based on this conceptual and empirical synthesis, the following hypothesis is proposed:

H4: Organizational agility positively moderates the relationship between digital leadership capabilities and digital organizational culture.



Methodology

This study adopts a quantitative, cross-sectional research design, which is well-suited for examining the relationships among organizational constructs at a single point in time. As the research objective implies, the aim of the study is to examine the impact of digital leadership capabilities on digital organizational culture, the economic performance, and environmental performance of the organization, with organizational agility as a moderator; therefore, the cross-sectional design will be used, because it will enable its researchers to collect feedback on a large sample in the most efficient way and

it will provide the opportunity to confirm the results generalizability. Quantitative designs are especially suited to a theory-driven hypothesis test and statistical modeling used in structural relationships and measuring (Creswell & Creswell, 2022). The design allows applying structural equation modeling (SEM), which is very essential in mediation and moderation tests in intricate theories. This study is also targeting the middle and high-level managers in the medium and large organizations in business-suitable sectors like manufacturing, services and technology which are also digitally active. These are the persons who are at perfect positions to give informed opinions about the leadership practices, cultures and performance metrics of their organizations. The population is of special concern since the leadership strategies, cultural dynamics, and organizational agility are normally formulated and implemented at the managerial levels (Zehir et al., 2022). The choice of this population will guarantee that the information represents the organizational realities and contextual variables which comply with the conceptual framework and theoretical assumptions of the research.

The study employed a stratified random sampling technique, ensuring that the sample includes respondents from various sectors and organizational sizes to enhance the diversity and representativeness of the data. The use of stratification by industry and company size (e.g. medium and large companies) was based on the fact that the two factors have been found to affect the success of digital transformation efforts and digital transformation adoption. The size of the sample was established with the guidelines of Item Response Theory (IRT), which concentrate on the psychometric qualities of each specific item and that the value of measurement is consistent all through the measuring continuum of the latent construct (Embretson & Reise, 2013). Since the study involves multi-item measures of variables like digital leadership, organizational culture, and performance outcomes, IRT forms a strong source of information pertaining to adequacy of items and sample size. The sampling size determined by the recommendations of IRT-Based modeling and the directions to the Partial Least Squares Structural Equation Modeling (PLS-SEM) was modified in such a way that 10 to 20 times the maximum number of structural paths directed toward any construct was taken as the minimum sample size (Hair et al., 2022). The sample size of at

least 300 was considered suitable since there were four latent constructs and the model comprised several paths. There were 342 valid answers obtained, which was more than the resting number sought to estimate the reliable SEM.. The data were gathered using a prepared, self-administered questionnaire, which was not only distributed in electronic forms (via email and Google Forms) but also given out in a one-on-one manner, so that it is accessible to everyone. The instrument used built-up on measurement scales of other references, simplified and contextually phrased by a pre-test of subject-matter experts. The analysis of the data was done on SPSS (Statistical Package for the Social Sciences) and SmartPLS (Partial Least Square Structural Equation Modeling). The preliminary data screening, the implementation of descriptive statistics, and the reliability tests (Cronbach alpha, skewness, and kurtosis) were initially performed using SPSS version 26, which is critical to allow confirming the data assumptions and adherence to normalcy and internal consistency. The rational to use path analysis and test the hypotheses using SmartPLS 4.0 was that this tool is especially helpful in exploratory modeling, complex mediation/moderation patterns, and data where normality restrictions cannot always be achieved under covariance-based SEM normality standards (Hair et al., 2022). SmartPLS enables bootstrapping and multi-group analysis, adding robustness to the examination of moderating effects.

Instrumentation

This study employed a structured, self-administered questionnaire as the primary data collection instrument. The development of the questionnaire consisted of validated multi- item scales founded on previous empirical studies, which resulted in both content validity and context relevance. Questions were designed on the seven-point Likert scale with answers varying between 1 (Strongly Disagree) and 7 (Strongly Agree), so that the respondents could offer more subtle opinions linked to leadership, culture, agility, and performance. Digital Leadership Capabilities were adapted items of Shao et al. (2023) evaluated the vision of leadership, flexibility, knowledge of the digital world, and the actions of change. Digital Organizational Culture Items related to openness to innovation, digital norms, knowledge sharing, and experimentation support were borrowed in Al-Mamary and Hassan (2022).

Organizational Agility assessed on a misadjusted scale (Li et al., 2022), that asks questions about how quickly decisions are made, being able to adapt to the change, and being flexible in operations. Economic Performance included perceived measures of financial performance of the company like profitability, market share development, and cost efficiency, taken with slight modifications based on Li et al. (2023). Environmental Performance: Some of the items evaluated the result of sustainability, such as energy efficiency, waste-reduction, and environmental-compliance, in reference to Raimo et al. (2022).

Data analysis

Table 1: Regression Weights

Variables		DLC	DOC	ENP	EP	OG
Digital Leadership Capabilities	DLC1	0.888				
	DLC2	0.864				
	DLC3	0.847				
	DLC4	0.824				
	DLC5	0.871				
	DLC6	0.896				
	DLC7	0.825				
	DLC8	0.914				
Digital Organizational Culture	DOC1		0.866			
	DOC2		0.910			
	DOC3		0.874			
	DOC4		0.909			
	DOC5		0.849			
	DOC6		0.866			
Environmental Performance	ENP1			0.889		
	ENP2			0.909		
	ENP3			0.896		

	ENP4			0.900		
	ENP5			0.889		
	ENP6			0.920		
	ENP7			0.863		
	ENP8			0.917		
Economic Performance	EP1				0.807	
	EP2				0.824	
	EP3				0.808	
	EP4				0.854	
	EP5				0.856	
	EP6				0.792	
Organizational Agility	OG2					0.764
	OG3					0.742
	OG4					0.825
	OG5					0.865
	OG6					0.813
	OG7					0.809

In structural equation modeling, factor loadings represent the strength and direction of the relationship between observed variables (indicators) and their underlying latent constructs. The are important in determining the reliability as well as convergent validity of the measurement model. The general consensus of scholars is that loadings older than 0.70 are sufficient and meaningful in terms of their effect on substantiating the construct on the confirmatory basis (Hair et al., 2022; Kline, 2023). In the research proposed, all indicators show significant factor loading which is well above the established line. In the case of Digital Leadership Capabilities, loadings are 0.824 to 0.914, which means that they are very high, and that the relationship of each item to the latent variable also is strong. Likewise, Digital Organizational Culture indicators indicate loadings of 0.849 to 0.910, illustrating that their relationship with the construct is very strong. The loadings on Environmental Performance items are very high i.e. between

0.863 and 0.920 implying a stable meaning of the Item is being measured. The factor loadings of the indicators of the Economic Performance are also adequate, i.e. between 0.792 and 0.856, and Organizational Agility indicators load between 0.742 and 0.865, which is the case also, being above the recommended cutoff. These findings are conclusive on the validity of the indicators as a measure of the corresponding latent variables with none of the items scoring below critical limits and being excluded. Additionally, the high similarity in loadings among constructs indicates low measurement error and this helps to increase reliability of the model. All the indicators were not discarded as all of them have the theoretical background and were empirically adequate in favor of the structural model's soundness, and in agreement with the best practices in measuring-validation. (Byrne, 2023; Sarstedt et al., 2022).

Table 2: Reliability analysis

Variables	Cronbach's alpha	(rho_a)	(rho_c)	(AVE)
Digital Leadership Capabilities	0.953	0.954	0.960	0.751
Digital Organizational Culture	0.941	0.943	0.953	0.774
Environmental Performance	0.966	0.979	0.971	0.806
Economic Performance	0.905	0.907	0.927	0.679
Organizational Agility	0.892	0.913	0.916	0.646

Internal consistency reliability and convergent validity are essential psychometric properties in structural equation modeling to ensure that latent constructs are measured accurately and consistently. Internal consistency is measured by Cronbach Alpha, rho_A and Composite Reliability (CR or rho C) and convergent validity by the Average Variance Extracted (AVE). As the methodological guidelines dictate, Cronbach Ahalpha of 0.70 and the rho A as well as Composite reliability of 0.70 or above is an acceptable indicator of reliability (Hair et al., 2022; Kline, 2023), whereas AVE above 0.5 indicates the construct to capture adequate variance of its indicators (Sarstedt et al., 2022). In the table provided, all the constructs have a high rate of internal consistency. Digital Leadership Capabilities has Cronbach Alpha 0.953, rho A

0.954 and Composite reliability 0.960, indicating an excellent reliability with 0.751 AVE indicated excellent convergent validity as well. In the same vein, Digital Organizational Culture demonstrates very satisfactory reliability coefficients (a = 0.941, rhoA = 0.943, rhoC = 0.953), as well as an AVE equals 0.774, which proves that the construct is sufficiently representative of its items. Environmental Performance records the best reliability values (alpha = 0.966, 979, 0.971, and 0.971) as well as a fairly strong AVE value of 0.806, implying almost flawless measurement. The economic Performance also has the desired threshold values (alpha = 0.905, 0.907, and 0.927) and the average composite reliability of 0.679, which is higher than the acceptable minimum, demonstrating sound validity. Organizational Agility indicates decent reliability (alpha = 0.892, rho A = 0.913, rho C = 0.916) and 0.646 as the AVE, which indicates that the construct possesses a good amount of explanatory power upon the items. All these results support the conclusion that all of the constructs in the model can be satisfactorily characterized in terms of reliability and validity which according to psychometrics are perfectly fine and which speak to the soundness of the measurement model. (Byrne, 2023; Sarstedt et al., 2022).

Table 3: HTMT VALUES

Variables	DLC	DOC	ENP	EP	OG
Digital Leadership Capabilities					
Digital Organizational Culture	0.576				
Environmental Performance	0.138	0.092			
Economic Performance	0.619	0.611	0.046		
Organizational Agility	0.441	0.475	0.141	0.482	

Discriminant validity assesses the degree to which constructs that are supposed to be distinct truly differ from one another in a structural model, ensuring that each construct captures a unique concept and not merely a reflection of others. The Heterotrait-Monotrait Ratio of Correlations (HTMT) is one of the strongest ways of assessing discriminant validity, and it is a

stricter measure than such conventional methods as Fornell-Larcker. Based on the recent methodological articles, strict discriminant validity can be achieved using HTMT values less than 0.85 with weaker models allowing possible acceptance of HTMT values less than 0.90 (Henseler et al., 2015; Hair et al., 2022). The examination of the HTMT presented table shows that none of the inter-construct relationships are equal to or above the liberal value of 0.90 and in most cases even 0.85. As an example, the value of the HTMT between Digital Leadership Capabilities (DLC) and Digital Organizational Culture (DOC) is 0.576 thereby indicating good discriminant validity. Likewise, DLC and Economic Performance (EP) demonstrate a figure of 0.619 and DLC and Organizational Agility (OG) 0.441 that fully satisfy established cut-offs to indicate the danger of failure. The values of HTMT between Environmental Performance (ENP) are quite low at the range of 0.046 and 0.141 and this again re-emphasizes that this construct is well differentiated of the other constructs. The findings of the study are allied towards defending the claim that the constructs within the measurement model possess desirable discriminant and conceptually distinct, hence making the structural model valid (Sarstedt et al., 2022; Hair et al., 2022).

Table 4: R SQAURE VALUES

Variables	R-square	R-square adjusted
Digital Organizational Culture	0.405	0.400
Environmental Performance	0.008	0.005
Economic Performance	0.323	0.321

The R-square values reflect the proportion of variance in each dependent variable explained by its associated predictors in the model, serving as a measure of explanatory power. The Digital Organizational Culture (DOC) R-square is 0.405, with the significant meaning that DOC variance is anticipated to be explained by Digital Leadership Capabilities and Organization Agility to the grip of around 40.50 percent, and with this, it is said that there is a moderate degree of succinct relevance. In a similar manner, the R-square of Economic Performance (EP) equals 0.323, which indicates that 32.3% of the variance in economic performance is explained by the predictors in the model, which is very acceptable in research settings in the social sciences field (Hair

et al., 2022). On the other hand, the R-square value of Environmental Performance (ENP) is -0.008 implying that only 0.8 percent of its variance was coded by the independent variables. This poor predictive value shows that there is something wrong with model specification or new alternatives to predict ENP. The stable nature of these results can be proved with the help of adjusted R- squares values.

Measurement Model Evaluation Summary

Table 5: Summary

Criteria	Threshold Value	Achieved Range	Interpretation	Reference
Cronbach's Alpha (α)	≥ 0.70 acceptable, ≥ 0.80 preferable	0.892 – 0.966	Excellent internal consistency	Hair et al. (2022)
Composite Reliability (CR)	≥ 0.70 acceptable, ≥ 0.80 preferable	0.916 – 0.971	Strong internal consistency	Hair et al. (2022)
Average Variance Extracted (AVE)	≥ 0.50	0.646 – 0.806	Strong convergent validity	Sarstedt et al. (2022)
HTMT (Heterotrait-Monotrait Ratio)	< 0.85 (conservative), < 0.90 (liberal)	0.046 – 0.619	Clear discriminant validity	Sarstedt et al. (2022)
R-Square (R^2)	≥ 0.75 (substantial), ≥ 0.50 (moderate), ≥ 0.25 (weak)	0.008 – 0.405	Moderate to weak explanatory power	Hair et al. (2022)

Structural Equation Modeling (SEM)

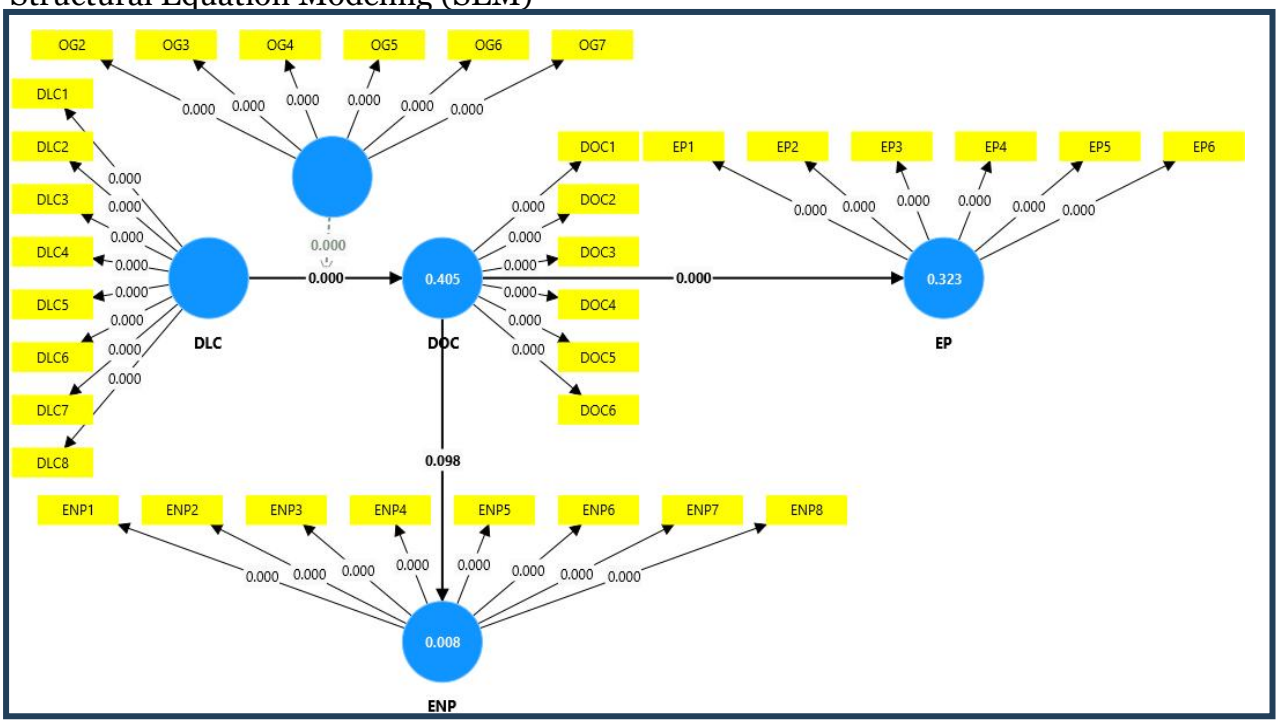


Table 6: Results

Hypotheses	Original sample	(M)	Std	T Value	P values
DLC -> DOC	0.421	0.421	0.041	10.158	0.000
DOC -> EP	0.568	0.570	0.042	13.657	0.000
DOC -> ENP	0.091	0.102	0.055	1.656	0.098
OG -> DOC	0.280	0.281	0.044	6.423	0.000
OG x DLC -> DOC	-0.168	-0.167	0.033	5.174	0.000

The results of the hypothesis testing offer meaningful insights into the relationships among the studied constructs. The path from Digital Leadership Capabilities (DLC) to Digital Organizational Culture (DOC) is statistically significant ($\beta = 0.421$, $t = 10.158$, $p < 0.001$), indicating strong support for the hypothesis that enhanced digital leadership positively influences organizational digital culture. The relationship between DOC and Economic

Performance (EP) is both strong and significant (β = 0.568, t = 13.657, p < 0.001), providing robust evidence that cultivating a digital culture contributes positively to economic outcomes. Conversely, the influence of DOC on Environmental Performance (ENP) is not statistically significant (β = 0.091, t = 1.656, p = 0.098), suggesting insufficient support for this hypothesis and implying that additional factors may mediate or moderate this relationship. The direct effect of Organizational Agility (OG) on DOC is significant (β = 0.280, t = 6.423, p < 0.001), reinforcing the assertion that agile capabilities facilitate a more adaptive and digitally oriented culture. The interaction term (OG × DLC) demonstrates a significant negative moderating effect on DOC (β = −0.168, t = 5.174, p < 0.001), suggesting that high levels of organizational agility may dampen the influence of digital leadership on digital culture.

Discussion:

The significant positive association between digital leadership capabilities and digital organizational culture (H1) indicates that when leaders articulate a clear digital vision, model technology use, and champion experimentation, those behaviors diffuse into shared values and routines that normalize digital work practices. This finding aligns with perspectives that digital transformation is fundamentally socio-cultural as much as technological; leaders signal priorities, allocate attention, and lower the psychological barriers to adopting new digital norms (Cortellazzo et al., 2022; Shao et al., 2023). In Dynamic Capabilities Theory terms, digitally adept leaders help the firm "sense" technological shifts and "seize" them by embedding corresponding mindsets in everyday practices (Teece, 2007; Teece et al., 2016). Empirical research similarly shows that leadership intent is translated into digital readiness when it is reinforced by communication, training, and symbolic acts that legitimize digital experimentation (Al-Mamary & Hassan, 2022; Chen et al., 2022). The strength of the path coefficient observed here suggests that such leadership behaviors were salient to respondents and had moved beyond rhetoric to become culturally resonant.

The robust positive effect of digital organizational culture on economic performance (H2) is consistent with research showing that digitally aligned values, openness to data, collaboration across silos, and tolerance for experimentation, improve process efficiency, innovation yield, and market

responsiveness (Jung et al., 2022; Li et al., 2023). From dynamic capabilities view, culture that prizes digital fluency accelerates the "seizing" and "transforming" phases: data travel faster, feedback loops shorten, and resource reconfigurations become less politically costly, enabling firms to capture economic rents from digital initiatives (Teece et al., 2016; Kane et al., 2022). Studies across industries report higher growth and profitability when cultural alignment reduces the implementation gap between digital strategy and frontline execution (Nguyen et al., 2023; Zehir et al., 2022). The comparatively high path coefficient in the present model suggests that cultural mechanisms, rather than technology investments per se, were a primary conduit to perceived financial gains in the sampled organizations, echoing the "people before tech" warning in transformation literature.

The path from digital organizational culture to environmental performance (H3) was positive but not statistically significant, indicating that a generally digital-supportive culture did not reliably translate into better ecological outcomes across firms. Several explanations are plausible. Environmental performance often depends on domain-specific capabilities, such as eco-design expertise, emissions analytics, or green supply chain integration, that may not be activated by generic digital norms (Raimo et al., 2022; Xiufan & Yunqiao, 2024). Organizations may prioritize revenue-linked digital initiatives over sustainability analytics when resources are constrained, producing an economic bias in capability deployment (Zhou et al., 2023; Mollah et al., 2024). Regulatory and stakeholder pressures for environmental reporting vary widely across sectors and national contexts; absent strong external triggers, digital culture alone may be insufficient to reconfigure production processes toward ecological targets (Fakhfakh et al., 2025; Rahman et al., 2022). Measurement issues may also matter, respondents might more readily perceive digital contributions to financial metrics than to diffuse, longer-horizon environmental indicators, attenuating observed effects. Future models could include intervening variables, green digitalization practices, environmental management systems, or leadership sustainability orientation, to capture the pathway more precisely.

Organizational agility both exhibited a direct positive effect on digital culture and negatively moderated the leadership–culture linkage, implying diminishing marginal returns of leadership where agility is already high. One plausible explanation is substitution: highly agile organizations may possess routinized sensing and reconfiguration processes that allow digital norms to propagate through cross-functional teams, rendering culture less dependent on top leadership cues (Di Stefano et al., 2022; Li et al., 2022). Another possibility is a ceiling effect, agile firms may already operate near an upper bound of digital cultural adoption, leaving less variance for leadership to explain (Popli et al., 2023). A contingency interpretation also fits DCT: when agility routines are strong, bottom-up learning cycles can outpace top-down leadership directives, attenuating the incremental influence of leaders on culture formation (Shams et al., 2022; Razzak et al., 2025). Methodologically, interaction terms can turn negative when the simple slope for leadership is strongest at low agility and flattens as agility rises; probing simple slopes in future work would clarify the functional form. Contextually, in fast-moving digital sectors represented in the sample, distributed decision rights and rapid iteration may shift cultural authority toward teams, diluting leader centrality.

Limitations and Future directions

Several limitations should be acknowledged to contextualize the study's contributions and guide subsequent inquiry. First, the cross-sectional design restricts causal inference. Although the structural paths estimated with PLS-SEM are theoretically ordered, reciprocal or lagged relationships (e.g., performance outcomes reinforcing digital leadership investments) cannot be ruled out (Creswell, 2022; Sarstedt et al., 2022; Teece, 2007). Temporal sequencing is central to Dynamic Capabilities Theory, which emphasizes sensing, seizing, and transforming over time; capturing these unfolding processes requires longitudinal or panel data designs capable of modeling change trajectories and feedback loops (Teece et al., 2016). Future research should therefore employ time-lagged, multi-wave, or cross-lagged panel designs to more convincingly establish directionality among leadership, culture, agility, and performance outcomes.

Data were collected using a self-administered survey from managerial respondents, creating potential common method variance (CMV) and

single-informant bias. Although validated multi-item scales were adapted from prior studies, mono-source perceptual data can inflate observed relationships when respondents project desired alignment across constructs, particularly for culturally valenced and performance-related measures (Byrne, 2023; Sarstedt et al., 2022; Hair et al., 2022). Social desirability may be especially salient for items referencing environmental stewardship, given increasing stakeholder scrutiny (World Economic Forum, 2023; Asif et al., 2024). Future studies should triangulate data sources by pairing leadership and culture perceptions from employees with objective or archival indicators of performance (e.g., financial ratios, emissions reports, ESG ratings) to mitigate CMV and sharpen construct discrimination. Multi-informant designs that nest responses across hierarchical levels would also permit cross-level agreement testing and measurement invariance assessment (Kline, 2023; Reise, 2013). Although the sampling strategy sought coverage across sectors, the sample remains geographically and contextually bounded, limiting external validity. Institutional logics, regulatory enforcement intensity, digital infrastructure maturity, and capital market pressures vary across national settings and can condition both the salience of digital leadership and the translation of culture into performance (Razzak et al., 2025; Rahman et al., 2022; Zupic et al., 2023). Emerging economy contexts often confront resource constraints and uneven digitalization that may privilege economic survival over environmental investments (Mollah et al., 2024; Tahir et al., 2024). Comparative, multi-country sampling, stratified by regulatory stringency or digital ecosystem development, would help determine whether the observed path strengths are context-specific or generalizable. Incorporating country-level moderators (e.g., digital readiness indices, environmental policy scores) could explicate macro-institutional boundary conditions (World Economic Forum, 2023).

While organizational agility was modeled as a global moderator, agility itself is multi-dimensional, encompassing sensing, decision, and resource reconfiguration speeds, and may interact nonlinearly with leadership and culture (Shams et al., 2022; Jasim et al., 2024). The observed negative moderation in this study could conceal curvilinear or threshold effects whereby agility amplifies leadership influence up to a point before

substituting for it (Popli et al., 2023; Li et al., 2022). Future studies should test alternative functional forms (quadratic, spline) and examine disaggregated agility dimensions as conditional effects. Longitudinal data would further allow examination of sequencing, whether leadership first builds agility, which later attenuates leader centrality as routines institutionalize (Teece et al., 2016). The environmental side of the model omitted mediating practices that plausibly connect digital culture to ecological gains. Prior work highlights "green digitalization" initiatives, IoT-enabled energy monitoring, AI-driven route optimization, digital product lifecycle analytics, as mechanisms through which digital mindsets translate into measurable environmental improvements (Raimo et al., 2022; Asif et al., 2024; Zhou et al., 2023). Sustainability leadership orientation, regulatory pressure salience, supply-chain collaboration depth, and stakeholder engagement intensity are additional mediators or moderators that could unlock the latent environmental value of digital culture (Razzak et al., 2025; Xiufan & Yunqiao, 2024). Incorporating these pathway variables would directly address why H3 was not supported and could reveal indirect effects masked in the current specification (Nguyen et al., 2023). Statistical concerns warrant note. Although sample size met recommended thresholds for PLS-SEM, future research should replicate the model using covariance-based SEM to test robustness under alternative distributional assumptions and to assess absolute model fit (Kline, 2023; Sarstedt et al., 2022). Multi-group PLS invariance testing across demographic or sectoral strata would strengthen claims of structural stability (Hair et al., 2022). Researchers should also probe potential endogeneity using procedures such as Gaussian copula approaches or instrumental variable techniques where feasible, given that high-performing firms may self-select into digital leadership investments (Popli et al., 2023; Teece, 2007).

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